

## Determination of Sr-90 in Urine by Empore Rad Disks

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This paper describes the results of an investigation to develop a rapid method for determination of Sr-90 in Urine samples while minimizing waste. Three different preparation techniques are tested for separation of Sr in Urine by the Empore Rad Disk. After sample preparation, the Rad Disk is placed in a glass vial with the Ultima Gold XR cocktail and is analyzed by Liquid Scintillation Counting (LSC). The advantage of the LSC analysis over gas proportional counting is that a cumbersome self-absorption curve does not have to be developed. The LSC analysis also provides spectral information that can assist in positive identification of Sr-90. For all tests, Sr-85 is added as a tracer and the prepared sample is analyzed by gamma spectrometry to determine sample specific chemical recovery.

The first test consisted of directly filtering 500 mL of a Urine sample through the disk. The direct filter sample took 4 days to filter even with a pre-filter through 12 membrane filters and had a chemical recovery of 62%. The membrane filters were ashed and dissolved and treated as a separate sample. The pre-filter took 4 hours of filtering and had a recovery of 11%. This is a good way to see if the Sr-90 stays with the solid materials or in solution. For cases where a higher MDA is tolerated, a 50 mL aliquot may be filtered directly within a reasonable time and provide an acceptable Sr recovery. The second test was conducted by evaporating and ashing the sample before introducing it to the disk. The evaporated/ash urine's ash was thick, white, and heavy but went into solution well. However, the chemical recoveries were highly variable, ranging from 20% to 60%.

For the third test, and the recommended one, a simple Calcium Phosphate co-precipitation step is added. Briefly, a urine sample is acidified to a pH < 2 with HNO<sub>3</sub> and mixed by stirring. A known amount of Strontium-85 tracer is added and mixed along with the sample. Strontium is co-precipitated as Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> using NH<sub>4</sub>OH to a pH > 8. The supernate is decanted away from the precipitate. The precipitate is dissolved with HNO<sub>3</sub>, wet ashed, muffled, and wet ashed again. The sample is dissolved in 4M HNO<sub>3</sub> and passed through an Empore Strontium Rad Disk to extract the strontium. The Sr recovery is consistent and close to 100%. Using 500 mL of urine for the sample size and an LSC count time of 100 minutes, a detection limit of 1.0 pCi/L is achieved. Overall, with an analysis time of 2 days, the method provides a rapid alternative to the traditional method that is based on a modified EPA procedure.

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